

## VIII. Taking Care of Water Quality Problems

Federal and state laws provide a framework for comprehensive water quality protection. Three federal and state regulations provide the foundation for protecting Arizona's water resources:

- **The federal Clean Water Act** – establishes a national goal to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. This act was amended in 1987 to include state nonpoint source management programs that address reduction of pollution associated with activities that do not have end-of-pipe discharge points and can have discharges that are dispersed over large areas (e.g., agriculture, urban runoff).
- **The federal Safe Drinking Water Act** -- requires that states develop programs to protect surface and ground water used for public drinking water systems through source water protection programs, and to ensure the delivery of safe water to these public systems.
- **The Arizona Environmental Quality Act** – gives ADEQ authority to develop state environmental protection programs for both surface and ground water (e.g., Aquifer Protection Permits, drywell registration, Pesticide Contamination Program, installation and remediation of Underground Storage Tanks and ground water monitoring).

This section will discuss the following programs established to identify and mitigate surface water quality problems in Arizona:

- The Nonpoint Source Program,
- Surface Water Monitoring,
- The Total Maximum Daily Load Program,
- Watershed Management, including volunteer monitoring, and the Grants and Outreach Program.

Many other water quality protection programs (e.g., permits, compliance and enforcement), also protect and mitigate water quality problems. Information about these programs can be obtained at ADEQ's web site: [www.adeq.state.az.us](http://www.adeq.state.az.us). The Ground Water Monitoring Program was discussed in Chapter VII.

### The Nonpoint Source Program

Early Clean Water Act programs concentrated on controlling point sources of pollution caused by discharges from large municipal and industrial sources. These programs achieved tremendous improvements in both groundwater and surface water quality. Despite these accomplishments, much remains to be done to achieve the goals of the Clean Water Act and ensure that the nation's waters are "fishable" and "swimmable." In addition to point sources of pollution, Arizona's water resources continue to be impacted by nonpoint sources of pollution. Nonpoint source pollution is now considered the single largest cause of water pollution throughout the nation.

ADEQ works with federal, state, tribes, local agencies, nonprofit organizations, the environmental community and local citizens to develop nonpoint source watershed management strategies to reduce nonpoint source pollution that degrades water quality. These management strategies rely on the cooperation of stakeholders that live within the watershed or have management responsibilities for the lands and the surface and ground water resources within. Arizona's Nonpoint Source Program relies on this type of cooperation, education and partnership as the primary method to reduce nonpoint source pollution and improve the state's water quality.

Arizona's Nonpoint Source Program focuses on the following land use activities that have been shown to negatively impact surface and ground water within the state:

- < Agriculture
- < Forestry
- < Urban runoff
- < Hydromodification
- < Onsite/septic waste treatment systems
- < Mining
- < Recreation

The Nonpoint Source Program aims to address water quality issues, educate the public to build a better understanding of the remaining water quality challenges and solutions, promote a public stewardship ethic and commitment, and encourage public involvement and support for watershed protection programs.

Arizona's Nonpoint Source Program integrates the state's Clean Water Act and Safe Drinking Water Act programs with voluntary incentives. ADEQ uses a combination of tools including: surface and ground water monitoring, watershed inventories, watershed characterizations, Total Maximum Daily Load (TMDL) studies, TMDL implementation plans, public drinking water system source water assessment plans, watershed-based plans, and water quality improvement projects to protect the state's water resources from nonpoint source pollution.

ADEQ's staff works closely with stakeholders to develop community-led, watershed-based planning efforts. These local planning efforts assist the Department in developing programs and outreach activities appropriate to the specific area and the issues. Since Arizona has a large amount of publicly owned lands, partnerships with federal, state and tribal land and resource management agencies are a key element in the program's success.

The other programs described in this chapter, along with the ambient Ground Water Monitoring Program described in Chapter VII, comprise the core of the Nonpoint Source Program administered in Arizona.

## Surface Water Monitoring

ADEQ's field personnel obtain water quality data that is used to assess the biological, chemical, and physical integrity of Arizona's rivers, streams, lakes, and reservoirs.

The primary objectives of this program are to provide credible data to support the following:

- Ongoing monitoring of the waters of the state as required by state law,
- Determine water quality trends at long-term sites,
- Characterize baseline water quality of surface waters located in selected watersheds according to the 5-year watershed monitoring schedule,
- Support surface water quality assessments, identify impaired surface waters, and the specific causes of impairment,
- Determine compliance with applicable surface water quality standards,
- Determine baseline water quality in the state's Unique Waters and to determine whether water quality is being adequately protected or is being degraded.
- Development of new water quality standards, especially for physical and biological integrity. For example, establish and determine trends at regional biocriteria and habitat reference sites in support of bioassessments and to test indexes of biological integrity/

**Fixed Station Network Monitoring** – One core of the ambient water quality monitoring program is ADEQ's Fixed Station Network (FSN). This monitoring program's primary purpose is to characterize baseline water quality of perennial, wadeable streams and to provide data to determine long-term water quality trends. This program incorporates longer monitoring time frames (more than 20 years ) and lower site densities than the Watershed Characterization Monitoring Program. ADEQ fixed sampling sites are sampled quarterly each year. Long-term fixed station sites have been established on wadeable, perennial streams in nine of the ten major watersheds in the state. USGS provides the fixed station sites in the 10<sup>th</sup> watershed -- the Colorado - Grand Canyon Watershed. (See USGS below.) Currently there are 28 ADEQ fixed station sites (**Figure 49**).

### Analytical Suite

Analytes being tested will vary based on the monitoring purpose. The following suite of analytes are collected at ambient monitoring sites:

- Field data:** Dissolved oxygen, pH, specific conductance, stream flow, turbidity, air temperature, water temperature, site characteristics, photographs. For lakes add redox, secchi depth, depth (not flow), and chlorophyll a.
- General chemistry:** Specific conductance, pH, calcium, magnesium, sodium potassium, chloride, sulfate, fluoride, turbidity, total dissolved solids, total suspended solids, hardness, carbonate, bicarbonate, alkalinity (total and phenolphthalein). For lakes add chlorophyll a and algae identification.
- Nutrients:** Ammonia (as nitrogen), phosphorus (total as phosphorus), nitrate/nitrite (total as nitrogen), total Kjeldahl nitrogen.
- Metals:** (total and dissolved) Antimony, arsenic, barium, beryllium, boron (total), cadmium, chromium, copper, lead, mercury, manganese (total), selenium, zinc.
- Bacteria:** *Escherichia coli*.

In addition, suspended sediment concentration will be collected at all future ambient stream sites.

**Table 41. Arizona's Watershed Schedule**

WATERSHEDS	FOCUS YEARS 1999 - 2011												
	99	00	01	02	03	04	05	06	07	08	09	10	11
Bill Williams					X					X			
Colorado - Lower Gila					X						X		
Colorado - Grand Canyon						X*					X		
Little Colorado - San Juan			X					X					X
Middle Gila				X					X				
Salt				X					X				
San Pedro - Willcox Playa - Rio Yaqui		X					X					X	
Santa Cruz - Rio Magdalena - Rio Sonoyta			X					X					X
Upper Gila		X					X					X	
Verde	X					X				X			

Note: Staff conduct watershed monitoring on the state fiscal year calendar, which starts July 1st and ends June 30<sup>th</sup> of the following calendar year. For example, 2004 starts on July 1, 2003 and ends June 30, 2004. \* Monitoring in the Colorado-Grand Canyon Watershed was deferred in 2004 due to budget constraints.

The purpose of this monitoring is to obtain basic water quality data on streams and lakes in each watershed. Along with the analytical samples collected (see analytical suite text box), annual bioassessments and habitat assessments are made each spring to assess the health of the aquatic communities in wadeable, perennial streams.

**USGS Cooperative Fixed Station Network Monitoring** -- For a number of years, ADEQ has participated in a joint funding agreement with the U.S. Geological Survey to operate the Cooperative Fixed Station Network monitoring program (USGS Co-op Program). The USGS conducts water quality monitoring at 16 USGS Co-op Program sites located on Arizona's larger rivers, which are of a size and annual flow that precludes ADEQ staff from the ability to monitor (Figure 49). USGS also maintains gage stations at these sites. Water quality data are collected quarterly at sites located on the Colorado River, Salt River, Gila River, Bill Williams River, and the Verde River.

**Watershed Characterization Monitoring** -- ADEQ has identified 10 major surface watersheds in Arizona. In 1998, ADEQ adopted a rotational watershed framework in which staff conducts water quality monitoring in wadeable, perennial streams located in two watersheds each year. All 10 watersheds are monitored over a 5-year cycle. The watershed schedule is shown in Table 41.

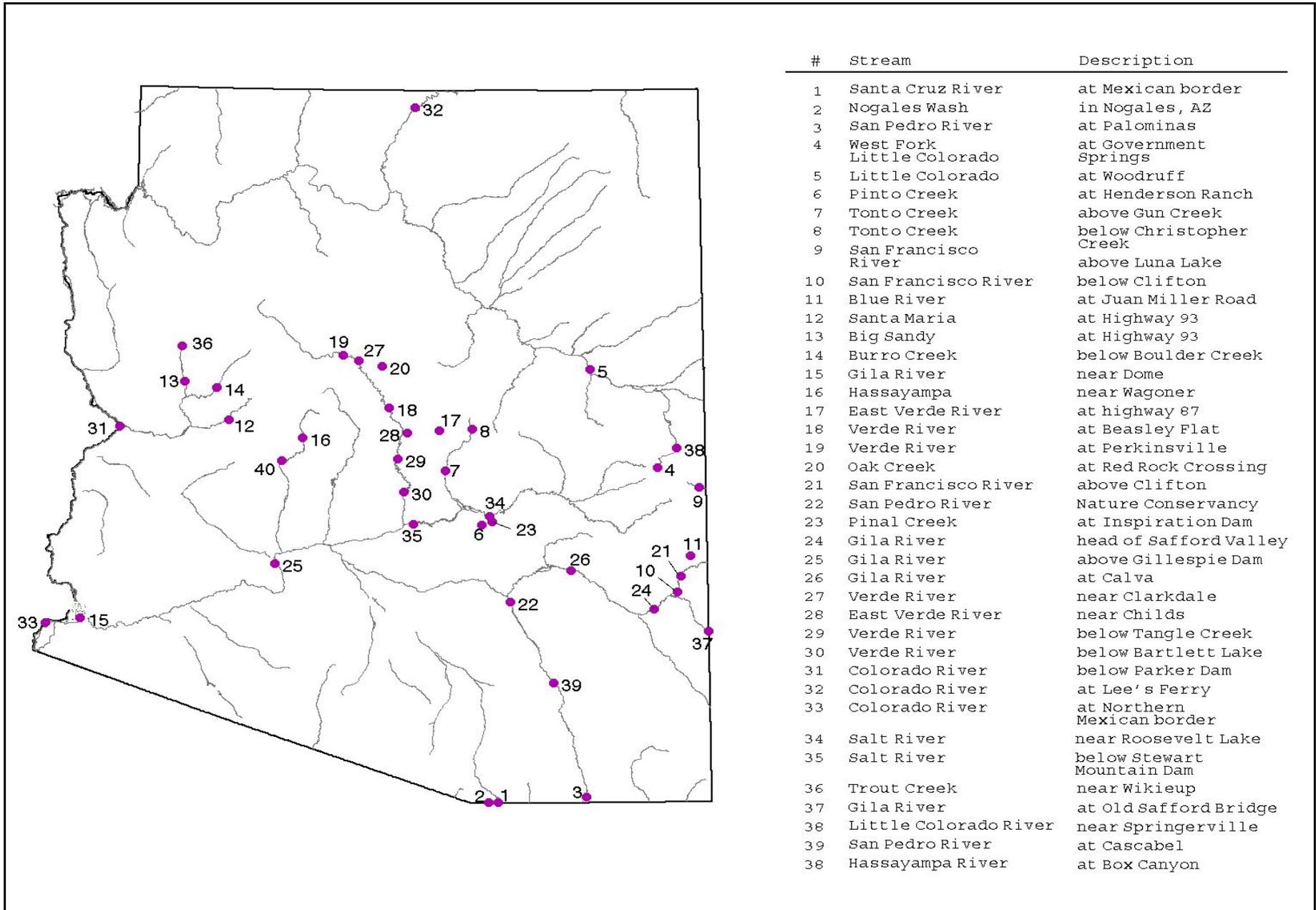


Figure 49. Fixed Long-term Monitoring Sites in Arizona – 2004

**Unique Waters** – As resources allow, surface water quality data are collected on Arizona’s outstanding state resource waters or “Unique waters” during the Watershed Characterization Monitoring. Currently, there are 18 Unique Waters in Arizona. The goal of this program is to acquire enough water quality data to determine water quality trends in these Unique Waters, and therefore, determine whether state antidegradation requirements are being met (i.e., is water quality improving, being maintained, or degrading).

**Biocriteria Program** -- Bioassessment data are being collected to support the development of Arizona’s biocriteria program. ADEQ began research to develop a state biocriteria program in 1992, focusing on using macroinvertebrate communities to assess the biological health of the aquatic system. A warmwater and a coldwater Index of Biological Integrity have been developed for Arizona through this research. Currently, the Biocriteria Program monitoring effort is to test existing indexes of biological integrity for warm and cold water streams over a range of impaired conditions and sources of stressors.

Bioassessments and habitat assessments are conducted at biocriteria reference sites, ADEQ FSN sites, watershed sites, and unique water sites to develop Arizona’s regional reference site network statewide and to monitor trends in reference conditions over time. The goal is to conduct bioassessments at a minimum of 10 biocriteria reference sites in each watershed each water year. Benthic macroinvertebrate samples in wadeable, perennial streams with suitable riffle habitats are collected during the spring index period (April, May, or June).

**Lakes Program** – Data and information on lake and reservoir water quality are collected by a team of field staff to identify water quality problems and determine potential sources of pollution. The overall monitoring objectives of the Lakes Program are to evaluate the water quality status of lakes and reservoirs by identifying natural and human-induced conditions affecting lake water quality and to develop feasible ways to maintain, protect, and restore lake water quality. Biological (algae and chlorophyll) , chemical, and physical limnology data are collected to characterize baseline water quality conditions.

The Lakes Program also follows the 5-year watershed monitoring schedule to organize it’s monitoring activities. Monitoring resources are focused on lakes and reservoirs located within the two major watersheds that are identified for study each water year. The Lakes Program monitoring activities incorporate four basic approaches:

- Baseline water quality monitoring and assessment,
- Targeted monitoring to fill assessment gaps identified on the Planning List,
- TMDL analyses to diagnose and recommend the most feasible ways to improve lake water quality, and
- A criteria development project to classify lakes, that will lead to class-specific water quality standards to protect the lake resources.

**Targeted Monitoring From the Planning List** - The Planning List that is generated during the assessment process identifies monitoring data gaps. Those waters with an overall ranking of high would be scheduled for monitoring in the two years following assessment report. Medium or low priority waters would be addressed in the subsequent three years, with the objective of having sufficient monitoring data on all waters on the Planning List within the current five-year watershed cycle. However, the current drought in Arizona may delay obtaining sufficient data during critical conditions on some waters on the Planning List.

Targeted monitoring focuses efforts on those surface waters that show the most potential for impairment. These intensive monitoring efforts are designed to ensure monitoring captures seasonality, spatial and temporal variations, and suspected critical loading conditions.

The factors used to prioritize TMDLs are similarly used for the Planning List, except that no designated uses have been assessed as “impaired.” In addition to those factors identified in the TMDL Priority Ranking section (next page), Planning List prioritization considers:

- < The number of exceedances compared to the number of samples taken, and the potential for completing the sample collection necessary to make an assessment;
- < Whether there are critical conditions (season, precipitation, activity in the watershed) when exceedances occur, so that sample collection is scheduled when these conditions are represented;
- < Watershed monitoring rotation, when listed due to insufficient data rather than exceedances;
- < Development of comprehensive watershed management plans; and
- < Whether the surface water has been on the 303(d) List in the past.

## Total Maximum Daily Load (TMDL) Program

ADEQ's TMDL Program must develop Total Maximum Daily Loads for each surface water identified as impaired. TMDLs must be initiated for surface waters identified as "high priority" within the first two years following list approval by EPA. All other waters ranking medium or low priority are scheduled for TMDL development within the next two 5-year watershed cycle. However, the fact that Arizona is in the fifth year of a drought poses a significant obstacle to the completion of scheduled TMDLs. Some impaired waters may flow only during precipitation events, while others may have water quality problems which only appear during heavy storms.

### A Total Maximum Daily Load Analysis (TMDL)

A TMDL is a written, quantitative plan and analysis to determine, on a pollutant specific basis, the maximum loading a surface water can assimilate and still attain and maintain a specific water quality standard during all conditions. The TMDL allocates the loading capacity of the surface water to point sources and nonpoint sources identified in the watershed, accounting for natural background and seasonal variation, with an allocation set aside as a margin of safety.

TMDL development leads to identification of a surface water load and waste load capacity for each pollutant. The final TMDL includes point source (waste load) allocations, nonpoint source (load) allocations, and load reductions necessary for attainment of water quality standards based on the critical conditions for loading. Records review, stakeholder interviews, field reconnaissance, field measurements, and modeling are performed to better understand the location, magnitude, and conditions causing the impairment. This process ultimately leads to an understanding of what needs to be done to reduce and prevent the impairment, and how long it might take the surface water to attain water quality standards.

The TMDL analysis starts with identification of the pollutants of concern and the water quality standards that must be attained to protect designated uses. Pollutant-specific numeric targets are set based on the most stringent water quality standard applicable to the surface water.

Source analysis then identifies the location and magnitude of point source and nonpoint source loadings. Point source waste loads are from discrete conveyances of discharge directly to a surface water (i.e. wastewater treatment plant outfall). Nonpoint source loads are from non-discrete discharges, including runoff generated by activities such as grazing, agriculture, mining and forestry. The TMDL also establishes the naturally occurring "background conditions" of the watershed, which are included in the nonpoint source load category.

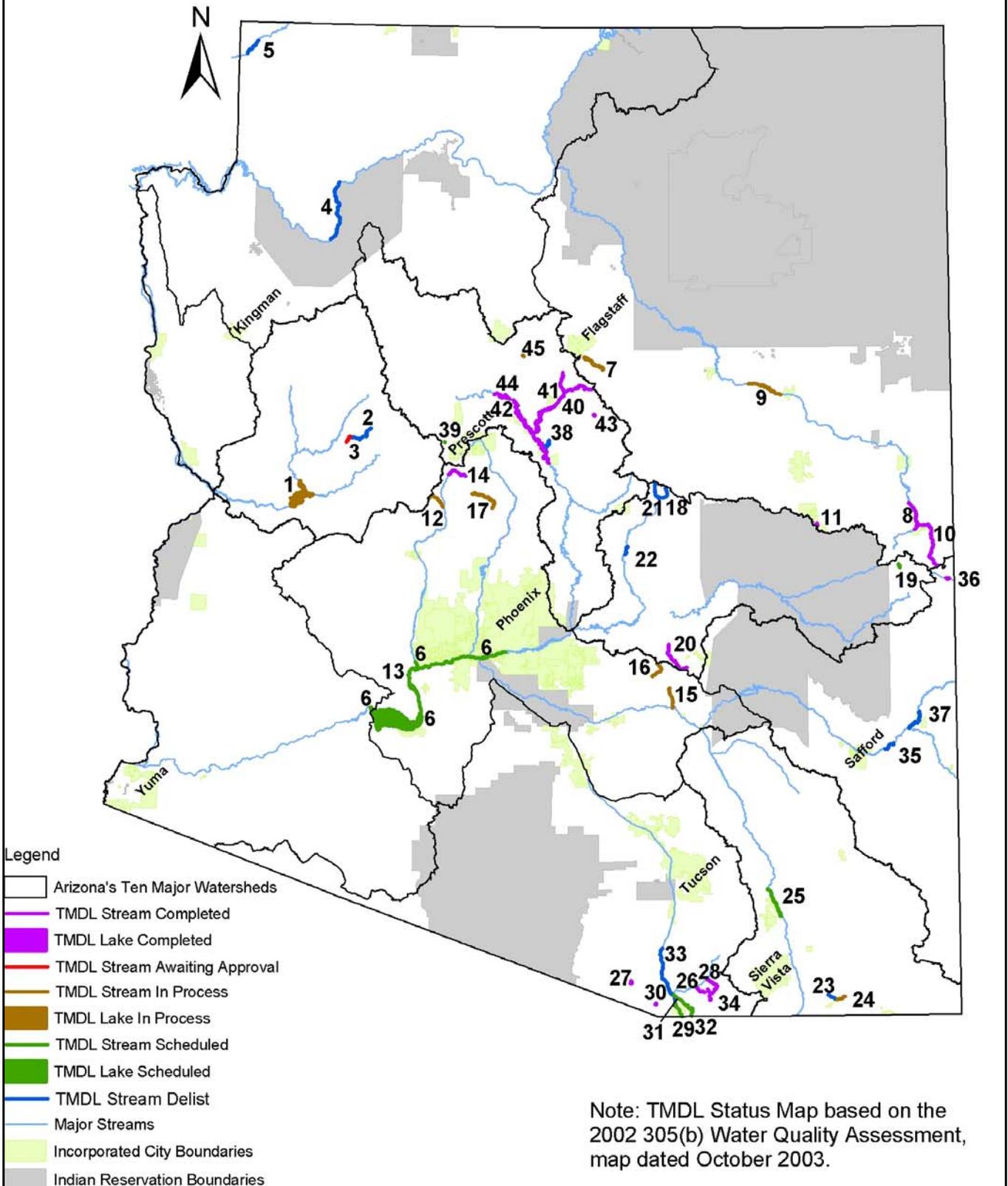
A pollutant specific load capacity, which includes a margin of safety, is calculated based on flow characteristics and the numeric target (generally the applicable surface water quality standard). When the load capacity and sum of the sources' contributions during the critical condition are compared, load allocations and necessary load reductions can be determined.

Waste load reductions from point sources can be managed through permitting programs such as Arizona's Pollutant Discharge Elimination System (AZPDES). However, there are no regulatory programs for nonpoint pollution, so load reductions from these sources are strictly voluntary. In Arizona, most surface water impairment is a result of nonpoint source pollution. Nonpoint source pollution may include excessive sediment caused by the denudation of grasslands, the location of roads, construction, bacteria from wildlife and/or recreation, metals from historic mining practices and road cuts through ore bodies, and pesticides from historic agricultural practices.

Stakeholders are encouraged to participate throughout the TMDL process. For most impaired surface waters, achievement of water quality standards will occur through voluntary efforts such as participation in watershed management groups, volunteer monitoring, pursuit of funding for cleanup measures, and education.

Since the current 303(d) List was approved in 2002, **XX** TMDLs have been submitted to EPA for approval. The status of surface waters on Arizona's 2002 List is illustrated in **Figure 50** on the next pages.

# TMDL Status Map



**Figure 50. Status of TMDLs in Arizona**

## Status of TMDL Development from 1998 - 2003 (for Figure 50)

Map #	Surface Water Name Segment Description	Waterbody ID	Pollutants of Concern Causing Impairment	TMDL Status
<b>Bill Williams Watershed</b>				
1	Alamo Lake	AZL15030204-0040	Mercury in fish tissue, high pH, sulfide, dissolved oxygen	In process Delisting sulfide (change in standard) Delisting dissolved oxygen (attaining standards)
2	Boulder Creek headwaters - Wilder Creek	AZ15030202-006B	Fluoride	Delisting fluoride (change in standard)
3	Boulder Creek Wilder Creek - Copper Creek	AZ15030202-005A	Arsenic, copper, zinc	Awaiting EPA approval of TMDL
<b>Colorado - Grand Canyon Watershed</b>				
4	Colorado River Parashant - Diamond Creek	AZ15010002-003	Turbidity	Delisting turbidity (change in standard)
5	Virgin River Beaver Dam Wash - Big Bend Wash	AZ15010010-003	Turbidity, fecal coliform	Delisting turbidity and fecal coliform (changes in standards)
<b>Colorado - Lower Gila Watershed</b>				
6	Painted Rocks Borrow Pit Lake	AZL15070201-1010	DDT metabolites, toxaphene, chlordane, low dissolved oxygen, fecal coliform	Scheduled Delisting fecal coliform (change in standards)
<b>Little Colorado - San Juan Watershed</b>				
7	Lake Mary (upper) Lake Mary (lower)	AZL15020015-0900 AZL15020015-0890	Mercury in fish tissue	In process
8	Little Colorado River Water Canyon - Carnero Wash	AZ15020001-009 AZ15020001-010	Turbidity	Complete
9	Little Colorado River Porter Tank - McDonalds Wash	AZ15020008-017	Copper, silver	In process
10	Nutrisio Creek headwaters - Little Colorado River	AZ15020001-017 AZ15020001-015	Turbidity	Complete
11	Rainbow Lake	AZL15020005-1170	Nitrogen, phosphorus, pH	Complete
<b>Middle Gila Watershed</b>				
12	French Gulch headwaters - Hassayampa River	AZ15070103-239	Copper, manganese, zinc	In process Delisting manganese (change in standards)
6	Salt River, 23 <sup>rd</sup> Ave WWTP - Gila River	AZ15070101-015 AZ15070101-014 AZ15070101-010 AZ15070101-009 AZ15070101-008 AZ15070101-007 AZ15070101-005 AZ15070101-001 AZ15070103-001B AZL15070101-1020 AZ15060106B-001D	DDT metabolites, toxaphene, chlordane	Scheduled
13	Gila River Centennial Wash - Gillespie Dam	AZ15070101-008	(Also listed above) Boron	Scheduled
14	Hassayampa River headwaters - Copper Creek	AZ15070103-007	Cadmium, copper, zinc	Complete
15	Miineral Creek Devils Canyon - Gila River	AZ15050100-012B	Copper	In process
16	Queen Creek headwaters - Superior Mine WWTP	AZ15050100-014A	Copper	In process
17	Turkey Creek headwaters - Poland Creek	AZ15070102-036B	Cadmium, copper, zinc	In process
<b>Salt Watershed</b>				

Map #	Surface Water Name Segment Description	Waterbody ID	Pollutants of Concern Causing Impairment	TMDL Status
18	Christopher Creek headwaters - Tonto Creek	AZ15060105-353	Turbidity	Delisting turbidity (change in standards)
19	Crescent Lake	AZL15060101-0420	pH	Scheduled
20	Pinto Creek headwaters - Ripper Springs	AZ15060103-018	Copper	Completed. Phase II TMDL in process (shown as complete)
21	Tonto Creek headwaters - Haigler Creek	AZ15060105-013	Turbidity	Delisting turbidity (change in standards)
22	Tonto Creek Rye Creek - Gun Creek	AZ15060101-008	Turbidity	Delisting turbidity (change in standards)
<b>San Pedro - Willcox Playa - Rio Yaqui Watershed</b>				
23	Mule Gulch headwaters - Bisbee WWTP discharge	AZ15080301-090A	Copper, zinc, low pH.	Delisting all parameters (Reach resegmented due to hydrology and contamination sources, all exceedances occur downstream)
24	Mule Gulch Bisbee WWTP discharge - Whitewater Draw	AZ15080301-090B	Copper, low pH, zinc	In process
25	San Pedro River Dragoon Wash - Tres Alamos Wash	AZ15050202-002	Nitrate	Scheduled
<b>Santa Cruz - Rio Magdalena - Rio Sonoyta Watershed</b>				
26	Alum Gulch headwaters - ephemeral reach	AZ15050301-581A AZ15050301-581B	Cadmium, copper, zinc, pH.	Complete
27	Arivaca Lake	AZ15050304-0080	Mercury	Complete
28	Harshaw Creek headwaters - ephemeral reach	AZ15050301-025	Copper, zinc, low pH	Complete
29	Nogales and East Nogales Washes Mexico border - Potrero Creek	AZ15050301-011	Chlorine, turbidity, fecal coliform	Scheduled Delisting fecal coliform (change in standard)
30	Pena Blanca Lake	AZL15050301-1070	Mercury	Complete
31	Potrero Creek Interstate 19 - Santa Cruz River	AZ15050301-500B	Fecal coliform	Delisting fecal coliform (change in standard)
32	Santa Cruz River Mexico border - Nogales International WWTP discharge	AZ15050301-010	Escherichia coli, fecal coliform	Scheduled Delisting fecal coliform (change in standard)
33	Santa Cruz River Nogales International WWTP discharge - Josephine Canyon	AZ15050301-009	Fecal coliform	Delisting fecal coliform (change in standard)
33	Santa Cruz River Josephine Canyon - Tubac Bridge	AZ15050301-008A	Fecal coliform, turbidity. (Fish abnormalities documented by the US Fish and Wildlife Service may indicate a narrative toxic standard violation.)	Delisting fecal coliform and turbidity (changes in standards)
33	Santa Cruz River Tubac Bridge - Sopor Wash	AZ15050301-008B	Fecal coliform	Delisting fecal coliform (change in standard)
34	Three R Canyon headwaters - ephemeral segment	AZ15050301-558A AZ15050301-558B AZ15050301-558C	Cadmium, copper, zinc, pH.	Complete

Map #	Surface Water Name Segment Description	Waterbody ID	Pollutants of Concern Causing Impairment	TMDL Status
<b>Upper Gila Watershed</b>				
35	Gila River Bonita Creek - Yuma Wash	AZ15040005-022	Turbidity	Delisting turbidity (change in standard)
36	Luna Lake	AZL15040004-0840	Dissolved oxygen, nitrogen, phosphorus, pH	Complete
37	San Francisco River Limestone Gulch - Gila River	AZ15040004-001	Turbidity	Delisting turbidity (change in standard)
<b>Verde Watershed</b>				
38	Beaver Creek Dry Beaver-Verde River	AZ15060202-002	Turbidity	Delisting turbidity (change in standard)
39	Granite Basin Lake AZL15060202-0580	AZL15060202-0580	Dissolved oxygen	Scheduled
40	Munds Creek headwaters -Oak Creek	AZ15060202-415	Nitrogen, phosphorus	Complete
40	Oak Creek headwaters - Verde River	AZ15060202-019 AZ15060202-018A AZ15060202-018C AZ15060202-017 AZ15060202-018	Nitrogen, phosphorus	Complete
41	Oak Creek At Slide Rock State Park	AZ15060202-018B	<i>Escherichia coli</i> , fecal coliform	Complete
45	Oak Creek West Fork Oak Creek-Dry Creek	AZ15060202-018A, B, and C	Turbidity	Delisting turbidity (change in standard and designated use)
46	Pecks Lake	AZL15060202-1060	Dissolved oxygen, pH	Complete
47	Stoneman Lake	AZL15060202-1490	Dissolved oxygen, pH	Complete
48	Verde River unnamed tributary (15060202-065) - West Clear Creek	AZ15060202-037 AZ15060202-025 AZ15060202-015 AZ15060202-001 AZ15060203-027	Turbidity	Complete
49	Whitehorse Lake	AZL15060202-1630	Dissolved oxygen	In process

Note that the map and table:

- Report on TMDLs completed after 1998
- Do not reflect 2004 303(d) Listing being sent to EPA, except where noting delisting,
- Show status on the map as "delist" only if all parameters are to be removed from the 303(d) List, while table may indicate that a parameter is being removed while others are remaining.
- Show status on the map as "complete," although the table indicates a Phase II TMDL has been initiated.

## Watershed Management

ADEQ focuses on six watershed management activities, which will be discussed in this section:

- C Development of water quality watershed-based management plans and watershed characterization studies, currently through the Nonpoint Source Education for Municipal Officials (NEMO) Project;
- C Development of TMDL implementation plans;
- C Coordination with local watershed groups across Arizona who are actively developing and implementing watershed-based plans and TMDL implementation plans;
- C Grants and outreach for available Water Quality Improvement Grants;
- C Volunteer monitoring; and
- C Regional 208 water quality planning.

Further information about these programs can be obtained at ADEQ's web site: <http://www.adeq.state.az.us>.

**Watershed-based Management Plans and the NEMO Project** -- Based on EPA guidance (*Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003*), watershed-based plans must include nine key elements. Where the watershed-based plan is designed to implement a TMDL, these elements will help provide reasonable assurance that the nonpoint source load allocations identified in the TMDL will be achieved. However, even if a TMDL has not yet been completed, EPA believes that these nine elements are critical to assure that public funds to address impaired waters are used effectively.

In broad terms, the elements that EPA requires for a watershed based plan are:

- Element 1: Causes and sources
- Element 2: Expected load reductions
- Element 3: Management measures
- Element 4: Technical and financial assistance
- Element 5: Information/education component
- Element 6: Schedule
- Element 7: Measurable milestones
- Element 8: Evaluation of progress

Element 9: Effectiveness monitoring

EPA funded a Nonpoint Source Education for Municipal Officials (NEMO) Project through the University of Arizona's Cooperative Extension Service. After experimenting with different ideas, University of Arizona and ADEQ agreed that this project would benefit Arizona most if the comprehensive characterization documents evolved into a watershed-based plans for the three target watersheds:

- C Bill Williams Watershed,
- C Verde Watershed, and
- C Upper Gila Watershed.

The goals of this project are:

- Characterize the watershed (soils, slope, population, geology, etc.);
- Identify areas that are susceptible to water quality problems and pollution (point and nonpoint sources). The plans will not only identify 303(d) listed or non-attaining waters, but also identify those waters/areas that are vulnerable to degradation;
- Identify the sources that need to be controlled to protect or improve water quality.
- Identify the problem areas ADEQ and/or stakeholders should address through monitoring or project implementation. Identify pristine areas (i.e. unique waters or special areas of concern) that need to be protected.
- Identify management measures to be implemented to protect or improve/restore water quality. Where and why? Estimate costs of the potential management measures.
- Estimate the load reductions expected from the different management measures. Rank the management measures to demonstrate which measures are the most effective means for protecting or restoring water quality.

These watershed-based plans will include many of the same elements of a TMDL implementation plan but are written for a much larger area. The University of Arizona will also include implementation recommendations that will assist ADEQ in focusing on potential problems and problem areas.

Once the plans are complete, the University of Arizona Cooperative Extension Service will educate local land-use decision makers and other stakeholders. Having watershed-based plans written for three of Arizona's large watersheds

will allow the Water Quality Improvement Grant Program to fund a wide variety of projects to control nonpoint source pollution.

This project will greatly increase the agency's knowledge of the watershed and help to more effectively fund water quality grant projects in Arizona. By characterizing and understanding the dynamics of each watershed, these watershed-based plans will also help ADEQ with their TMDL and monitoring efforts. Watershed characterizations will help the monitoring programs improve site selection and identify priority-planning sites.

**TMDL Public Involvement and TMDL Implementation Plans** -- ADEQ tries to proactively involve and educate the stakeholders affected by the TMDL process. The goal is to involve these stakeholders while the TMDL is being written, so that citizens are aware of the problems up-front and can realize their role in helping remedy the identified problems through development of a TMDL implementation plan.

After the load and wasteload allocations are established in the TMDL, corrective actions or changes in practices must be implemented in the watershed so that these allocations will be met in the future. TMDL Implementation Plans (TIPs) provide a strategy that explains how the allocations in the TMDL and any reductions in existing pollutant loadings will be achieved and the time frame in which compliance with applicable surface water quality standards is expected to be achieved. These plans may include a phased process with interim targets for load reductions.

Based on EPA guidance, each implementation plan includes the following components:

- A description of the Best Management Practices, or other management measures, and associated costs that must be implemented to achieve the load reductions estimated in the plan. An identification (using a map or a description) of the critical areas where those measures are needed.
- An estimate of the overall load reductions which the plan expects to achieve. An estimate of the load reductions expected for each of the management measures or BMP (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Costs should also be included.

- An action plan for implementing the management measures identified in the plan. This would include a schedule of interim, measurable milestones for determining whether the management measures or other control actions are being implemented effectively.
- A description of methods that will be used to evaluate the progress and effectiveness in achieving the plan goals.
- An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing BMPs.
- An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement the plan.

TMDL Implementation Plans use the information contained in the TMDL to develop a plan that encompasses the entire area causing known or potential pollution and contributing to the impairment. Scale varies depending on the causes and sources of contamination. Through active public involvement during the TMDL development, by the time the TMDL is completed, a TMDL Implementation Plan should also be written.

Development of these plans are to be community-led, when possible, and focus on encouraging volunteer groups to lead the way in implementing water quality improvement projects through the use of ADEQ's Water Quality Improvement Grant Program or other funding sources. The goal is to make sure that all of Arizona's waterbodies are clean and safe for uses such as swimming or fishing.

**Watershed Groups -- How Can I Get Involved?** — The importance of working with interested participants at the watershed level can not be overstated. All affected parties need to clearly understand the issues impacting water quality. To implement successful strategies improve water quality, these strategies will need to be tailored to the social and hydrological reality within each watershed or drainage area. Implementation of the best water quality improvements will be constrained by the legitimate resource limits.

Watersheds are a geographic areas with natural boundaries that do not correspond with political boundaries. City, county, state, and federal jurisdictions provide a maze of legal and political perspectives, as well as different and diverse management goals to work through. For any comprehensive watershed approach to have long term success, it will need to involve private and public landowners, numerous political jurisdictions and coalitions of special interest groups. Through federal, state, and local partnerships, we are achieving our goal of providing a cleaner, safer environment and ensuring its integrity for future generations.

A list of active watershed partnerships in Arizona is provided in **Table 42**. (The drainage areas the partnerships are involved in currently are illustrated on **Map XX -- not yet drafted**). These groups vary in their purpose and scope of concern as some groups were established primarily for oversight for a specific TMDL, while others have more long-standing concerns about water quality and water quantity in their watershed.

States, territories, and tribes are directed by EPA to collaboratively develop watershed-based plans. Watershed-based plans are effective and cost efficient ways to implement strategies, and restore the health of watersheds. The management strategies will rely on the cooperation of all people, and stakeholders that live within the watershed or have management responsibilities for the lands and the waterbodies within. ADEQ relies on this type of cooperation, education, and partnership as the primary method to reduce nonpoint source pollution and improve the state's water quality.

By involving local communities, tribes, and private-sector organizations, Arizona is focusing and prioritizing restoration activities to achieve demonstrable improvements in water resources, aquatic ecosystems and watershed health. More information is at: [www.adeq.state.az.us/function/forms/appswater.html](http://www.adeq.state.az.us/function/forms/appswater.html).

**What Funds are Available to Implement Strategies?** -- Numerous funding sources can be used for projects that improve water quality in Arizona. Three of those funds include:

- Water Quality Improvement Grants administered by ADEQ,
- Water Protection Funds administered by the Arizona Department of Water Resources, and
- Clean Water and Drinking Water Revolving Funds administered by the Water Infrastructure Finance Authority.

Water Quality Improvement Grants -- ADEQ distributes grant funds under Section 319(h) of the federal Clean Water Act to both public and private entities within Arizona. These grants are to implement on-the-ground water quality improvement projects that address nonpoint sources of pollution.

Grant applications that contain activities identified in a watershed-based plan (or equivalent plan) are given priority over other projects.

For a grant application to be considered eligible for evaluation, the application must comply with the process described in the current *Water Quality Improvement Grant Program Manual*, and the project description must indicate how all of the following will be accomplished:

- Improve, protect or maintain water quality in a waterbody in Arizona by addressing a nonpoint source of pollution;
- Demonstrate acceptable water quality management principles, sound design, and appropriate procedures;
- Yield benefits to the state at a level commensurate with project costs;
- Have an on-the-ground implementation component within Arizona;
- Provide for at least 40% of the project costs as non-federal match;
- Support the ADEQ, Water Quality Division Mission; and
- Be eligible under applicable state and federal regulations.

The Water Quality Improvement Grant Manual provides details about the grant program and includes the application forms. For more information about the Water Quality Improvement Grant Program or to be added to the mailing list, please contact the grant coordinator at (602) 771-4635 or, toll free in Arizona, (800) 234-5677, Ext. 771-4635, or email at: [Rodine.Jean@ev.state.az.us](mailto:Rodine.Jean@ev.state.az.us) or on the web site at: <http://www.adeq.state.az.us/environ/water/watershed/fin.html>.

**Table 42. Arizona Watershed Partnerships**  
(STILL DRAFTING THIS TABLE)

Name of Partnership	Primary Objectives	When and Where Meeting	Contact
<b>Bill Williams Watershed</b>			
Upper Bill Williams Partnership		3 <sup>rd</sup> Monday of the month Skull Valley Community Center	Alice Dixon, Allison@jakesrun.com
Boulder Creek?			
<b>Colorado - Grand Canyon Watershed</b>			
Northwest Arizona Watershed Council		3 <sup>rd</sup> Wednesday of the month Kingman	Elno Roundy (928) 757-2818
Arizona Strip Regional Planning Task Force		Every two months on Wednesday Fredonia	Arizona Alliance, Jim Matson <a href="mailto:jmatson@xpressweb.com">jmatson@xpressweb.com</a> or Jan Bundy, Box 231, Fredonia, AZ 86022
<b>Colorado - Lower Gila Watershed</b>			
Northwest Arizona Watershed Council		3 <sup>rd</sup> Wednesday of the month Kingman	Elno Roundy (928) 757-2818
<b>Little Colorado - San Juan Watershed</b>			
Little Colorado River Multi Objective Management Group (LCR MOM)		Every other 3 <sup>rd</sup> Wednesday, for 2 days Holbrook or Winslow	Jim Boles (928) 289-2422
Upper Little Colorado River Watershed Partnership		General membership and technical advisory group meetings on 3 <sup>rd</sup> Thursday of the month. Springerville	Bill Greenwood (928) 333-4223 or <a href="mailto:bgreenwood@eagar.com">bgreenwood@eagar.com</a>
Silver Creek Watershed Partnership		2 <sup>nd</sup> Monday of the month Holbrook	Tom Thomas, Town of Pinetop, 1360 North Niels Hansen, Lakeside Arizona 85929 (928) 368-8885
Billy Creek Watershed Partnership Show Low Creek Watershed Partnership	Combined forces with Silver Creek Watershed to develop a water budget (water quantity).		Pete Shumway or Tom Hieb. Tom Heib's phone (928) 524-4108
<b>Middle Gila Watershed</b>			
Upper Agua Fria Watershed Partnership		2 <sup>nd</sup> Tuesday of the month Arcosanti	Mary Hoadley (928) 623-7135 earthhous@aol.com

<b>Salt Watershed</b>			
Pinto Creek Watershed	Pinto Creek TMDL		
Northern Gila County Watershed Partnership (a.k.a. Mogollon Highlands)		1 <sup>st</sup> Thursday of the month Star Valley	
<b>San Pedro - Willcox Playa - Rio Yaqui</b>			
Campomocho-Sacaton Watershed Group		Quarterly meetings Willcox	Donna Matthews (520) 384-2229, ext 122 or donna.matthews@az.usda.gov
Mule Gulch???	Mule Gulch TMDL		
Upper San Pedro Partnership		2 <sup>nd</sup> Wednesday of the month Sierra Vista	George Michael (520) 378-4046
Middle San Pedro Partnership		Monthly, varies Benson	Run by Resource Conservation and Development agency
Lower San Pedro Partnership		Monthly, varies Cascabel	Run by Resource Conservation and Development agency
<b>Santa Cruz - Rio Magdalena - Rio Sonoyta Watershed</b>			
Friends of the Santa Cruz River		3 <sup>rd</sup> Thursday of the month Tubac	Ben Lomealee, President (520) 281-4904
<b>Upper Gila Watershed</b>			
Gila Watershed Partnership		2 <sup>nd</sup> Tuesday of the month Safford	Jan Holder (928) 428-5537, ext. 110 or <a href="mailto:watershedholder@yahoo.com">watershedholder@yahoo.com</a>
Eagle Creek Watershed Partnership		As needed on Saturdays	
<b>Verde Watershed</b>			
Oak Creek Canyon Task Force		2 <sup>nd</sup> Thursday of the month Sedona	Barry Allen (602) 953-1291
Verde Watershed Association		3 <sup>rd</sup> Tuesday of the month Prescott, Cottonwood, Camp Verde (varies)	Robert Hardy (928) 634-5526
Water Advisory Committee		3 <sup>rd</sup> Wednesday of the Month varies	John Munderlow (928) 771-3200
North Central Arizona Regional Watershed Consortium			Barbara Litrell, President (928) 649-0135 or blitrell@aol.com

Map of watershed partnerships

Water Protection Funds – In 1994, the Arizona Water Protection Fund was established to implement projects that would maintain, enhance, and restore rivers, streams, and associated riparian resources, including fish and wildlife that are dependent on these habitats. In previous years, the legislature has provided \$5,000,000 annually in grants to fund proactive incentives to implement water quality and water quantity restoration actions. However, in 2003, funding was limited to \$2,000,000 due to deficits in the state budget.

Any individual, entity, state or federal agency, or political subdivision of Arizona may submit an application to the Arizona Water Protection Fund Commission. For further information, please contact the commission at (602) 417-2400 extension 7016.

Clean Water and Drinking Water Revolving Funds – The Water Infrastructure Finance Authority of Arizona (WIFA) is an independent agency of the state authorized to finance the construction, rehabilitation and/or improvement of drinking water, wastewater, wastewater reclamation, other water quality facilities/projects. Generally, WIFA offers borrowers below market interest on loans for 100% of eligible project costs.

- Clean Water Revolving Fund (CWRF) for eligible publicly-held wastewater facilities,
- Drinking Water Revolving Fund (DWRF) for eligible publicly- and privately-held drinking water systems; and,
- Technical Assistance Program (TAP) Pre-design and design grants and loans for eligible wastewater and drinking water systems.

WIFA also manages a Technical Assistance Program. The program offers pre-design and design grants to eligible wastewater and drinking water systems under 10,001 population. Pre-design and design loans are available to all eligible systems. The purpose of the Technical Assistance Program is to enhance project readiness to proceed with a WIFA project construction loan.

**Volunteer Monitoring Program** – Across the nation, volunteer groups monitor the condition of streams, rivers, lakes, reservoirs, estuaries, coastal waters, wetlands, and wells. They do this because they want to help protect a stream, lake, bay or wetland near where they live, work, or play. Their efforts are of particular value in providing quality data and building stewardship of local waters.

Volunteers can make visual observations of habitat, land uses, and the impacts of storms, measure the physical and chemical characteristics of waters and assess the abundance and diversity of living creatures; aquatic insects, plants, fish, birds, and other wildlife. Volunteers can also clean up garbage-strewn waters and become involved in restoring degraded habitats. The number, variety, and complexity of these projects continues to increase.

During the next year, ADEQ will be devoting efforts to develop a Volunteer Monitoring Program. Volunteer groups across Arizona will be able to collect data to supplement the water quality information collected by ADEQ. The volunteer data can be used by ADEQ to: screen water for potential problems, further research or restoration efforts, establish baseline conditions or trends for waters that would otherwise go unmonitored, and help evaluate the success of Best Management Practices implemented to mitigate problems. Helping volunteer groups to collect credible and scientifically defensible water quality data is important since ADEQ, like many other organizations, must continue to do more with less resources in both personnel and funding.

Since 2003, ADEQ has been working closely with GateWay Community College in Phoenix, Arizona to develop a modular water quality curriculum to train volunteers and others in proper sampling techniques, development of Sample and Analysis Plans and Quality Assurance Plans, and care and maintenance of equipment. The goal is to have a curriculum that can be tailored to the specific needs of the group while providing ADEQ with valuable water quality information.

ADEQ looks forward to working with volunteer monitoring groups. This coordination will also ensure, to the extent practical, that the groups collect data that meet Arizona's credible data requirements in the *Impaired Waters Identification Rule* (Arizona Administrative Code R18-11-6) and can therefore be used to assess the status of water quality in Arizona's surface waters.

**Regional 208 Water Quality Management Planning** -- Areawide Waste Treatment Management Planning was authorized by the Clean Water Act Section 208 in 1972. It requires regional planning agencies to develop comprehensive water quality management plans. These plans require existing and proposed wastewater treatment facilities to meet the anticipated municipal and industrial waste treatment needs of an area over a 20-year period, as well as provide general planning guidance for nonpoint source, sludge, stormwater and other activities. The plans assure attainment of the state's water quality standards.

Currently, the Designated Planning Agencies are: Maricopa Association of Governments (MAG), Pima Association of Governments (PAG), Northern Arizona Council of Governments (NACOG), Central Arizona Association of Governments (CAAG), Southeastern Arizona Governments Organization (SEAGO), and La Paz, Mohave and Yuma Counties.

The Watershed Management Unit's 208 Program is responsible for three main tasks:

- 208 Consistency Reviews that assure that the proposed facility or usage will be consistent with the existing Certified Regional Water Quality Management Plan,
- Coordinating water quality management plan amendment approvals, and
- Providing technical support and outreach to regional planning agencies in developing comprehensive Water Quality Management Plans.

This outreach includes participation in the Water Quality Management Working Group bi-monthly meetings. The working group consists of the eight Designated Planning Areas and various state, federal or local entities involved in regulatory water quality planning. They meet bi-monthly to review plan amendments and make recommendations to ADEQ on regulated water quality management issues.

ADEQ continues to work with the Designated Planning Areas on incorporating a watershed-based approach to the 208 process. These watershed-based discussions also encourage the Designated Planning Areas to begin focusing more efforts on the nonpoint source side of the program. This is a slow process because the DPAs were established on political jurisdictional lines; however, pollution knows no such boundaries.

## Putting it all together

The programs described in this chapter work together to improve the quality of Arizona's water resources. The table below illustrates the water quality improvement process and the parties involved from start to finish, using a demonstration stream. Through this process, ADEQ strives to preserve, protect, and enhance water resources in Arizona by generating scientifically based monitoring data, using clear assessments methods, and encouraging public involvement.

<b>Example Watershed</b>	
<b>Step #1</b>	<b>Surface Water Monitoring and Standards Program</b> Establishes water quality standards for John Doe Creek.
<b>Step #2</b>	Field personnel obtain water quality data that is used to assess the biological, chemical, and physical integrity of John Doe Creek.
<b>Step #3</b>	<b>Volunteer Monitoring Program</b> Works with volunteer groups across Arizona to collect data. These data supplement water quality data and information collected by ADEQ and other agencies on John Doe Creek.
<b>Step #4</b>	<b>Watershed Management Unit</b> Completes state water quality assessment (305b Report) and John Doe Creek is identified as impaired and placed on the 303(d) List of impaired waters for copper and zinc.
<b>Step #5</b>	<b>TMDL Unit</b> Completes a TMDL study for copper and zinc on John Doe Creek.
<b>Step #6</b>	<b>Watershed Management Unit</b> Develops a TMDL implementation plan to improve water quality in the creek and identifies an action plan with milestones to be implemented by the stakeholders.
<b>Step #7</b>	<b>Grants and Outreach Unit</b> The stakeholders within the John Doe Creek watershed apply for a Water Quality Improvement Grant and receive priority because there is a TMDL implementation plan in place.
<b>Step #8</b>	The project(s) is approved and the Grants and Outreach Unit is responsible for managing the project.
<b>Step #9</b>	<b>Volunteer Monitoring Program</b> Works with project managers or other volunteer groups to collect data. These data help to determine the effectiveness of the management measures that are implemented, as identified in the TMDL implementation plan.
<b>Step #10</b>	<b>Grants and Outreach Unit</b> The water quality improvement project is completed and the project is closed out.
<b>Step #11</b>	<b>TMDL Unit</b> The targeted monitoring group conducts follow-up water quality monitoring, which indicate that John Doe Creek is meeting water quality standards and the stream is added to the list of "attaining" waters.

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